Teacher at Sea Lesson Plan

Title: Satellite Tracking with Argos

Subject: Technology in Earth and Physical Science

Grade Level: 9th grade

Average Learning Time: One class, 83 minutes

Lesson Summary: Students will research how animal tracking is accomplished with the Argos satellite and analyze some data from tagged sharks.

Overall Concept: Technology is used to enhance scientific methods. Students will understand how the use of satellite tracking provides new and important data to scientists.

Specific Concepts: - Satellites are becoming an important scientific tool for data collection.

- There are many steps involved before data is available to the scientists.
- Location data is one piece of the complex puzzle of animal behavior.

Focus Questions: How is remote sensing used to study the behavior of sharks?
What path does the data signal take when traveling from animal to scientist?
How can the data be beneficial?
What are some of the limitations of the data?

Objectives/Learning Goals: - Given the 5 components of the data path, students will place them in proper order and explain the role of each component with an accuracy of 80%.

- Given the data maps from specific sharks, students will make 4 calculations of the movement of their shark with an accuracy of 80%.
- Using the shark data maps, students will make observations about what the data can/can not tell us about shark behavior.

Background Information: Students should have the computer skills to be able to maneuver within a website. It would be helpful for students to have a very general knowledge of satellites and electromagnetic radiation (usually covered in middle school) to better understand this lesson. The topic for my previous lesson is "What are satellites and how are they used?" Students should know how to read and understand a map.

Common Misconceptions: A common misconception is that advanced technology has all the answers. Satellite tracking of animals makes new positioning data available, but it doesn't answer all the questions for scientists. Also, the number of satellites in use is much greater than most people realize.

Materials: internet access, shark data maps, handouts, metric ruler, calculator.

Technical Requirements: computers with internet access

Teacher Preparation: Familiarize yourself with the Argos satellite and how it is used for animal tracking. A helpful website is www.argos-system.org . The NOAA website also has lots of information on satellites in general and Argos in particular.

Keywords: Polar orbit, transmitting platform, receiving stations, processing centers.

Lesson Procedure: 1. The lesson introduction will be accompanied by images on a power point presentation. We will quickly review ways to collect data using remote sensing, then we will focus on one example of that process by looking more closely at how the Argos satellite is used to track sharks.

2. Students will complete a worksheet using the Argos website www.argos-system.org which outlines the animal tracking procedure.

3. Using data maps of TAS sharks, students will list observations and calculations of the shark's movements.

4. As a class, discuss results and map analysis. Submit worksheet.

Assessment and Evaluation:

Formative assessment can be made as the teacher interacts with the students during both the online and data analysis portions of the lesson. The work sheet could serve as a summative assessment.

Standards:

National Science Standards:

H.U.3.C-Unifying Concepts and Processes–Measurement makes quantitative observations about objects, events, or systems. The goal is to help students use tools of measurement and measurement systems and to achieve understandings of scales and rates.

H.A.2.C- Science as Inquiry- Scientists rely on technology to enhance the gathering and manipulation of data. New techniques and tools provide new evidence to guide inquiry and new methods to gather data, thereby contributing to the advance of science. The accuracy and precision of the data, and therefore the quality of the exploration, depends on the technology used.

H.E.2.b- Science and Technology- Science often advances with the introduction of new technologies. Solving technological problems often results in new scientific knowledge. New technologies often extend the current levels of scientific understanding and introduce new areas of research.

Ocean Literacy Principles:

#7 The ocean is largely unexplored. D-New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

State Science Standards:

GE 50-Natural Resources -b. Technology provides us with a variety of sophisticated information about the interrelationships and distribution of species and the synergistic effects of environmental disturbance. Humans use knowledge of science and technology, together with strategies of design, to solve practical problems to sustain or enhance natural/agricultural resources.

Additional Resources: How many satellites are currently in orbit?
http://www.youtube.com/watch?v=cfSaztUiw5s

Argos System www.argos-system.org

Wildlife Tracking www.wildllifetracking.org

Author: Liz Harrington, Essex High School, 3 Educational Dr., Essex Jct., VT 05452, eharrington@ccsuvt.org

Creation Date: November 2013

Student Worksheet

Go to the Argos website at www.argos-system.org

From the menu across the top, click "system". From the dropdown menu click "How it works"

1. View the animation to understand the path the data travels.

2. Define each term:

Platform-

Satellite-

Receiving stations-

Processing Centers-

3. Click on the satellite link.

At what altitude does the satellite travel?

How long does it take to complete one revolution around the earth?

What is a satellite's *visibility circle*?

Why do these satellites see polar transmitters with every pass, but not equatorial transmitters?

What is the time period for which a satellite can receive a message from a particular platform?

Click on "Receiving stations".

What is the approximate number of receiving stations worldwide?

View the map and list three areas around the world that are not covered by receiving stations.

Where are the three main receiving stations located?

Click "Processing centers".

Where are the two processing centers located?

Data Analysis

General observations

1. Using all of the data maps, what 3 similarities do you see in the shark's movements? 3 Differences?

2. What does the color represent on these maps?

3. How does the color representation here differ from the color representation when you mapped the ocean floor?

4. How do the days at large vary from shark to shark? What does that tell you?

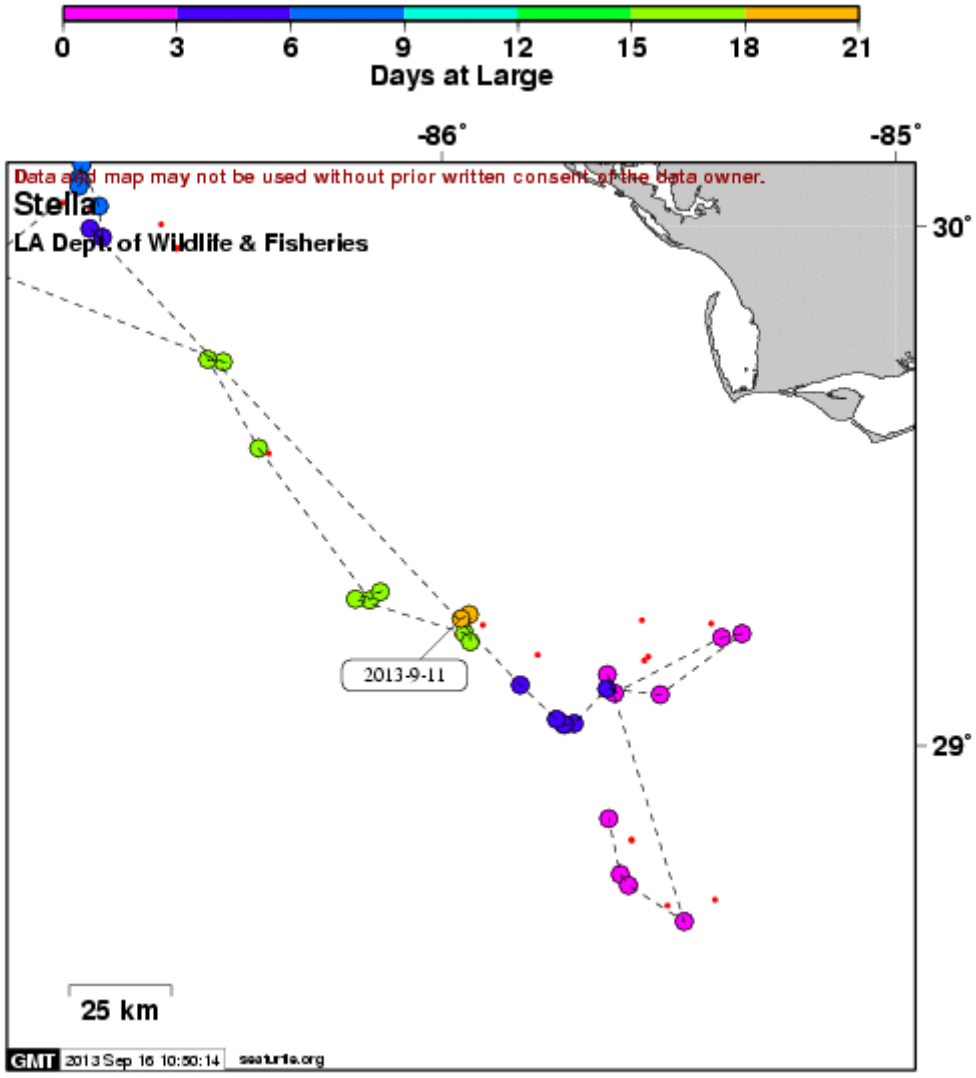
Specific calculations

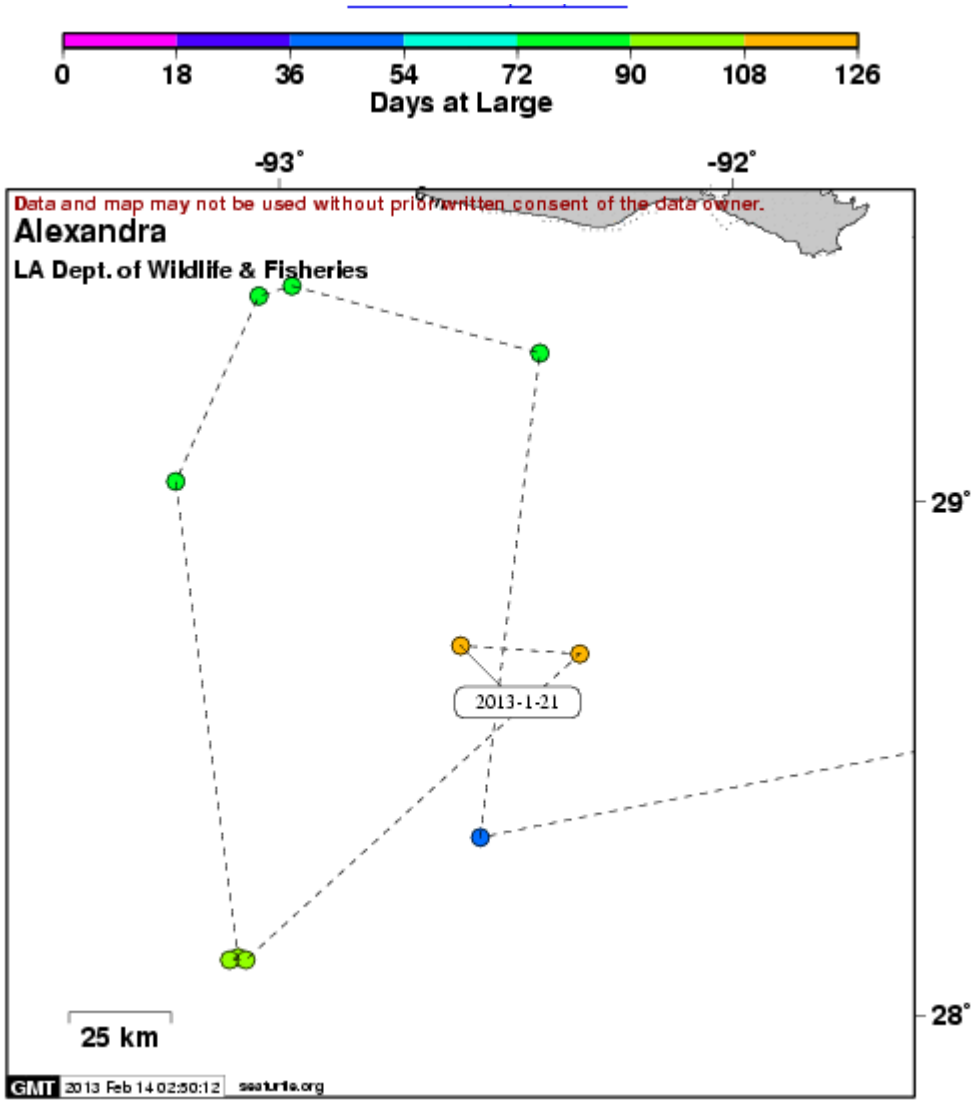
5. Choose one shark map to analyze. Measure the longest distance between 2 consecutive points. Use the scale to estimate the distance.

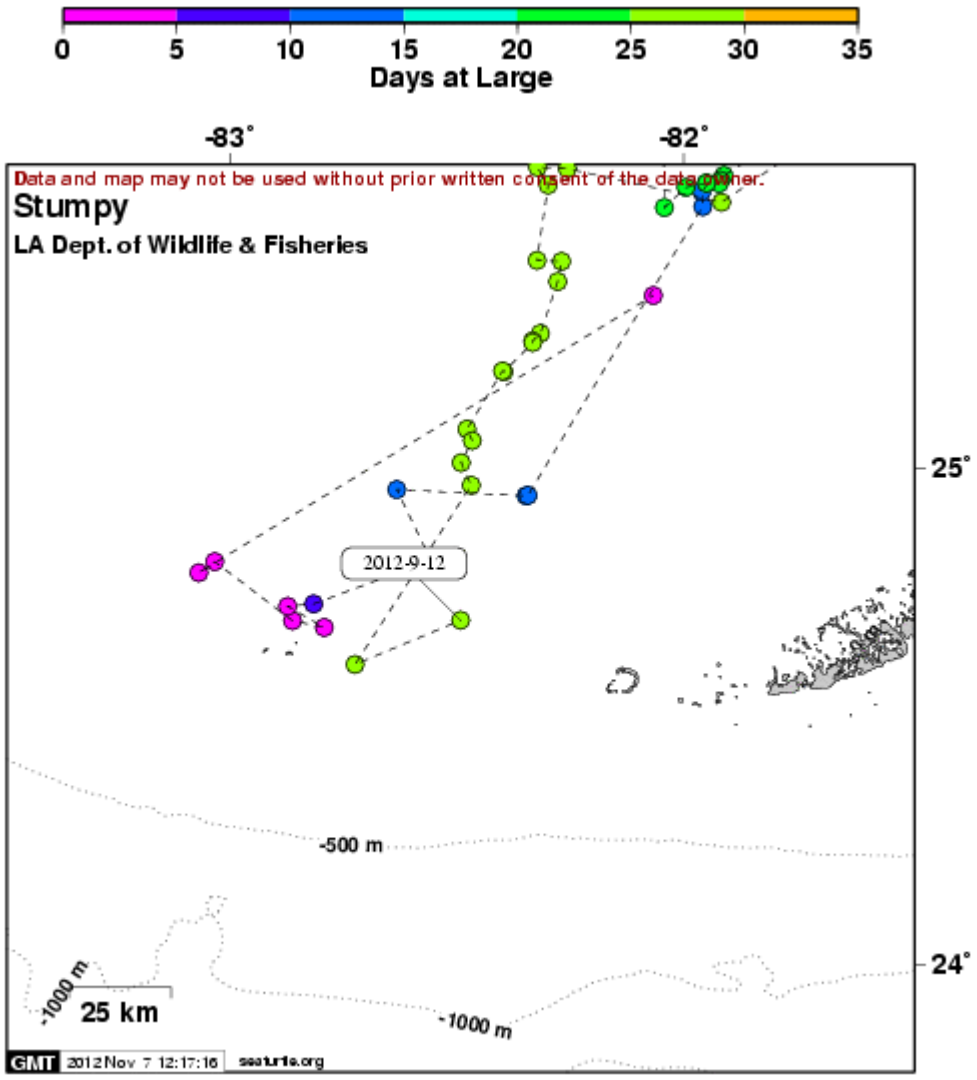
6. Take an inventory of each color dot. Describe the shark's movements over the time at large.

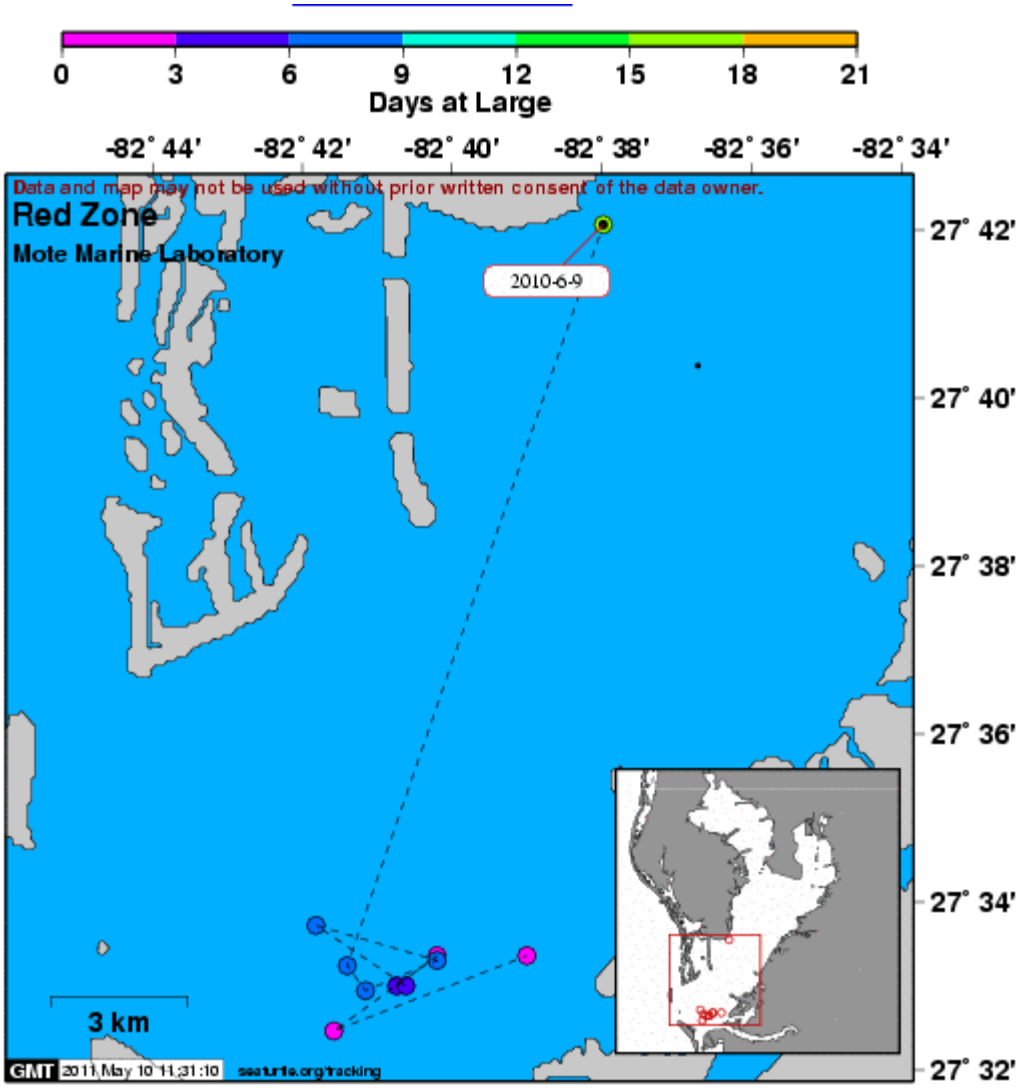
7. Determine the distance between the two farthest points of any color.

8. If you were a shark biologist, what other parameters (temp.,weather,..) might you want to check against your shark map data to get a better understanding of shark behavior?


0
3
6
9
12
15
18
21
Days at Large
-86°
-85°
Data and map may not be used without prior written consent of the data owner.
Stella
LA Dept. of Wildlife & Fisheries
30°
29°
2013-9-11
25 km
GMT 2013 Sep 16 10:50:14
seaturtle.org

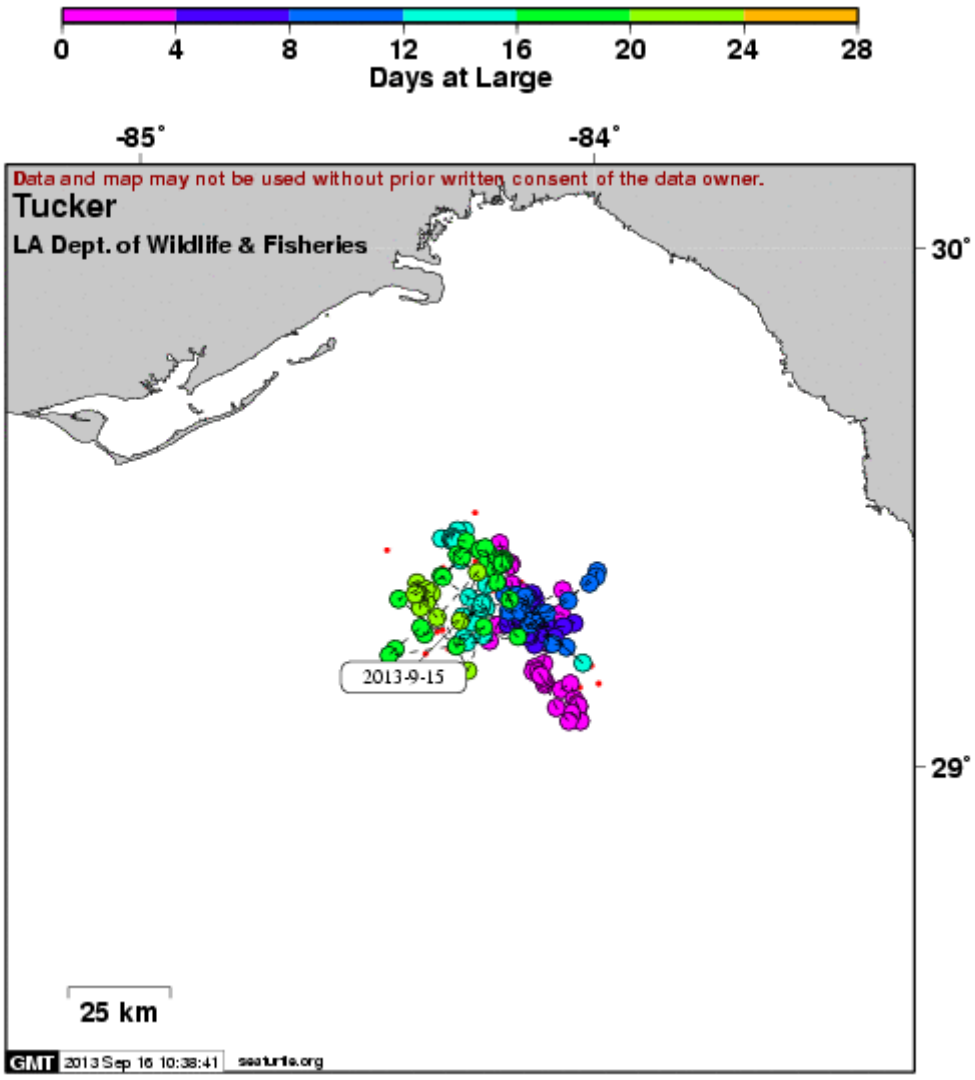

0
18
36
54
72
90
108
126
Days at Large
-93°
-92°
Data and map may not be used without prior written consent of the data owner.
Alexandra
LA Dept. of Wildlife & Fisheries
29°
28°
2013-1-21
25 km
GMT 2013 Feb 14 02:50:12
seaturtle.org


0
5
10
15
20
25
30
35
Days at Large
-83°
-82°
Data and map may not be used without prior written consent of the data owner.
Stumpy
LA Dept. of Wildlife & Fisheries
2012-9-12
25°
24°
-500 m
-1000 m
-1000 m
25 km
GMT
2012 Nov 7 12:17:16
seaturtle.org



Distance Traveled: 32 km **Straight-line Distance: 18 km**

Position of tagging and subsequent locations coming from 'Red Zone's' satellite tag


0
4
8
12
16
20
24
28
Days at Large
-85˚
-84˚
Data and map may not be used without prior written consent of the data owner.
Tucker
LA Dept. of Wildlife & Fisheries
30˚
29˚
2013-9-15
25 km
GMT 2013 Sep 16 10:38:41
seaturtle.org